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ABSTRACT

A project was conducted to develop three metric education modules for use with bilingual (Spanish and English) students in postsecondary and adult vocational education programs. Developed for the first section of each module, five instructional units cover basic metric concepts: (1) measuring length and finding area, (2) measuring volume, (3) measuring time and finding speed and acceleration rates, (4) measuring mass and power, and (5) measuring temperature and energy. The second major section of each module was designed to illustrate applications (presented in 6-7 units) of metric measurement to task performance and problem solving in one of three occupational areas: agriculture (grounds keeper, private pesticide applicator, agricultural mechanic, veterinarian assistant, grain elevator foreman, fence builder, and gardener); business and office (mail clerk, proofreader, clerk-typist, secretary, bookkeeper, office manager, and word processor), and trade and industrial occupations (draftsman, machinist, welder, automotive tune-up mechanic, electrician, and electronics service technician). Each module unit is organized into the following elements: objectives, suggested activities for instructor and student, information sheets, transparency masters, assignment and job sheets, and tests and answer keys. (JH)

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# FINAL REPORT

## BILINGUAL METRIC EDUCATION MODULES FOR POSTSECONDARY AND ADULT VOCATIONAL EDUCATION

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BILINGUAL METRIC EDUCATION MODULES FOR

POSTSECONDARY AND ADULT VOCATIONAL EDUCATION

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## BILINGUAL METRIC EDUCATION MODULES FOR POSTSECONDARY AND ADULT VOCATIONAL EDUCATION

### INTRODUCTION

This report represents the final documentation of a project in which three metric education modules were developed for use with bilingual (Spanish and English) students at the postsecondary and adult levels, and field tested at the postsecondary level. The modules were developed for the vocational education areas of Agriculture, Business and Office, and Trade and Industrial.

### BACKGROUND/RATIONALE

When the Metric Conversion Act of 1975 was signed into law, the country was charged with providing a "national program in order to make the international metric system the predominant but not exclusive system of measurement in the United States and to provide for converting to the general use of such system within ten years." As the nation moves forward, under law, toward the increased use of metric measurement, the need to become familiar with the basic concepts of the Système Internationale d'Unités (SI) -- the modern metric system -- increases. This internationally recognized measurement system is used by 30 major nations, which means that 95 percent of the world's population is now using, or converting to, the metric system.

American industry has moved toward use of SI because it is advantageous to do so in the world market; the utilization of internationally accepted measurement standards increases the availability of materials or components, the ease of calculations, and export sales. During the Senate hearings on metrication, it was reported that 37 corporations had announced policies of adopting metric measurement, and that retailers were beginning to act on metric conversion. Significantly, General Motors anticipates virtually complete conversion of automotive operations by the early 1980s.

Metric conversion for this country is at hand. Every person -- as worker, as consumer -- will be touched by the change. Products will be manufactured and marketed under the metric system; specifications and instructions will be written using SI metric standards.

Many consumers and workers of all ages, no doubt, will find it difficult to become oriented to the metric system. Various vehicles must be found for this education process. One obvious setting in which to learn metric measurement skills is the school. As education, in general, moves to accommodate the metrication process, vocational education, in particular, will be required to adjust and supplement curricula. Vocational educators will assume the important task of providing practical metric orientation for people preparing for, or already in, the world of work.

Many students and worker/students will find the learning of new measurement skills no easy task. For persons with limited English-speaking ability, the problems will probably be even more severe.

This project addressed the Spanish-speaking -- a group that constitutes 5.3 percent of the total U.S. population and sees one out of every four of its number existing at below the nationally defined low-income level. Approximately 11.2 million people were identified by the Bureau of Census (March 1975) as being of Spanish origin. This census figure, coupled with a distressing economic profile, demands that the Spanish-speaking be helped to equip themselves to cope -- as workers and as consumers -- with various aspects of a complex society. This project was intended to provide assistance with metric education for the Spanish-speaking and to reduce the practical difficulties they may encounter in this area.

While it is true that many of the Spanish-speaking persons in this country are from nations in which some form of the metric system is used, it cannot be assumed that such persons have a grasp of the SI metric system in use in the United States, or are aware of the most recent standards and notations of SI metrics. If the Spanish-speaking are to acquire good metric measurement skills, then metric education must be available to them in Spanish as well as in English. The modules developed for this project will equip students with limited English-speaking ability with the knowledge of metrics applicable to both current and future occupational roles, and current and future life roles.

## OBJECTIVES

The primary objective of this project was to develop the most effective metric education materials possible for Spanish-speaking vocational education students with limited English-speaking ability to ensure that they would be equipped with the same baseline understanding of metric applications in employment and in consumer and domestic activity that their English-speaking peers will possess. The secondary objective was language development and reinforcement.

Within these general objectives, there were eight specific objectives which have been delineated in the PROJECT TASKS section of this final report.

## PRODUCTS/END RESULTS

The basic products of this project were three metric education modules (English and Spanish language versions of each) for use with Spanish-speaking students in postsecondary and adult vocational education programs. The English and Spanish titles of these are:

1. Agriculture -- "Applying the Metric System (SI) in Vocational Agriculture Education" (554 pages)

   "Aplicando el Sistema Métrico (SI) a la Educación Vocacional en Agricultura"

2. Business and Office -- "Applying the Metric System (SI) in Business and Office Education" (535 pages)

"Aplicando el Sistema Métrico (SI) a la Educación Vocacional en Administración de Negocios y Procedimientos de Oficina"

3. Trade and Industrial -- "Applying the Metric System (SI) in Trade and Industrial Education" (539 pages)

"Aplicando el Sistema Métrico (SI) a la Educación en los Oficios de Comercio e Industria"

These materials provide instruction first, in the fundamental concepts of the metric system, and second, in the application of those concepts to specific Agriculture, Business and Office, and Trade and Industrial occupations.

The modules are presented as teachers'/students' manuals, containing information and materials to be used by both teachers and students. The design of the modules is consistent with sound prevocational and career education principles. Each instructional unit in the modules includes a statement of objectives, suggested activities for instructor and student, information sheets, assignment sheets, visual aids, tests, and test answers. Each unit is planned for one or more lessons or class periods of instruction.

Core Units

The first section of each module, called "Metric System of Weights and Measures," is comprised of five instructional units covering basic, or core, metric concepts. These five core units, with unit titles which indicate the particular kinds of metric measurement concepts they include, are:

I. Measuring Length and Finding Area

II. Measuring Volume

III. Measuring Time and Finding Speed and Acceleration Rates

IV. Measuring Mass and Power

V. Measuring Temperature and Energy

The core units use the "common reference point" approach to instruction in which new terms and concepts associated with the metric system are related to terms and concepts with which the student is already acquainted. This approach, combined with the use of SI-calibrated tools and equipment, permits effective instruction in the metric system at multiple levels of vocational education.

The basic concepts are presented in the context of consumer and family living applications, and serve as the foundation of the metric knowledge needed for adapting to metrication and problem solving in the various occupational cluster units. However, the design of the core units allows for their presentation independent of the balance of the module materials, to meet the needs of teachers interested only in teaching metric concepts.

Occupational Applications Units

The second major section of each module encompasses metric applications in a selected occupational cluster. The Agriculture and Business and Office modules contain seven applications units each; the Trade and Industrial module has six. (During the translation phase of the project, an industrial decision was made not to change paper sizes to metric specifications for the present. Therefore, a seventh unit on graphics was eliminated from the Trade and Industrial module.) Following are the applications units selected for each module:

Metric System Applications in Agriculture Occupations

- Grounds Keeper
- Private Pesticide Applicator
- Agricultural Mechanic
- Veterinarian Assistant
- Grain Elevator Foremen
- Fence Builder
- Gardener

Metric System Applications in Business and Office Occupations

- Mail Clerk
- Proofreader
- Clerk-Typist
- Secretary
- Bookkeeper
- Office Manager
- Word Processor

Metric System Applications in Trade and Industrial Occupations

- Draftsman
- Machinist
- Welder
- Automotive Tune-Up Mechanic

- o Electrician
- o Electronics Service Technician

Each occupation listed is presented in a unit which illustrates applications of metric measurement to task performance and problem solving in that occupation. (The occupational application units do not attempt to treat, in depth, comprehensive instruction in the occupations; they are designed to demonstrate to students that knowledge of the metric system is useful, and increasingly necessary at some level in virtually any occupation they choose.)

The learning units for each occupation included in the modules contain:

1. Brief outline of occupation
2. Brief outline of tasks normally performed
3. Description of selected tasks involving use of metric measurement
4. Explanation of metric knowledge needed by persons performing particular tasks
5. Set of exercises in which students, using their metric measurement skills, assume worker roles and perform the tasks required
6. Unit test

Throughout the occupational applications units, accepted guidelines for elimination of sex bias in curriculum development were followed.

Consumer Applications

Consumer application components are presented as integral parts of the modules rather than as separate units. By paralleling basic metric concepts and occupational examples of metric measurement use with consumer examples of metric applications, the perception of dual applicability of metric knowledge is reinforced and heightened. It is noteworthy that the materials covering basic metric concepts and the consumer applications contained therein can be used by the U.S. Office of Education in the eventual development of modules for the vocational education program areas not addressed by this project.

Module Introduction and Appendices

Each module contains a brief introductory section entitled "Use of this Publication" which is valuable to all users of the module. Background information on national metrication is given along with an outline of the general presentation of materials. Information on the use of instructional units in bilingual classes is provided. A final paragraph lists guidelines and rules of notation for the SI metric system.

The module appendices include a Matrix of Common Multiples and Submultiples, a "Common Terms and Definitions" glossary, and a section which contains

brief descriptions of the occupations included in the module from the Dictionary of Occupational Titles.

PROJECT TASKS

In order to achieve the project objectives and produce the end products, tasks were organized as follows:

Task 1 - Develop Overall Design of Modules

Task 2 - Develop Introductory Metric Concepts Presentation

Task 3 - Develop Consumer Components for Modules

Task 4 - Develop Occupational Applications

Task 5 - Prepare Materials in Bilingual Format

Task 6 - Conduct Field Test

Task 7 - Finalize Module Materials

Task 8 - Prepare and Submit Final Products

A summary of the activities conducted within each of these tasks is delineated below.

Task 1: Develop Overall Design of Modules

Activities during this initial phase consisted of refining plans for modules to be developed, reviewing existing metric education materials, examining basic metric concepts for best presentation design, determining appropriate reading level for widest target population, and developing the overall packaging design of the modules.

The original project proposed the development of seven bilingual metric education modules -- one for each of seven vocational education areas. Because the funds available were less than required to conduct the project as originally envisioned, it was necessary to reduce the scope of work. Through grant negotiations, the number of modules to be developed was reduced from seven to three.

The rationale for selecting the three vocational education areas of Agriculture, Business and Office, and Trade and Industrial was:

1. Agriculture remains an important employment area for the Spanish-speaking population in the southwestern and southern regions of the United States.

2. Business and Office job opportunities exist nationally for both men and women, and may be even more plentiful, in many areas, for persons who are bilingual. The employment projection figures are encouraging in this vocational area.

3. Trade and Industrial occupations have drawn a large proportion of the Spanish-speaking work force. Further, these occupations are particularly sensitive to the changes brought about by metrication.

4. A telephone survey of vocational leaders in the greater southwest indicated that education in these three vocational areas is in great demand.

Existing metric education materials -- textbooks, conversion tables, industrial guides and reports, metric bibliographies, pamphlets, government publications, filmstrips, available teaching tools and instruments -- were reviewed to ascertain their potential value to the project. Other bilingual vocational education projects were identified and information related to their progress was requested. Selected occupational information was collected, organized, and analyzed. Meetings were held with Spanish-speaking leaders in various fields for guidance in meeting the needs of the target population. Consumer problems during the metrication process were examined.

After review of existing metric education materials, it was determined that the best presentation design for introduction of basic metric concepts would be by measurement function. Considering the levels of difficulty involved and typical classroom time scheduling, the basic concepts units were divided as follows:

Unit I. Measuring Length and Finding Area

Unit II. Measuring Volume

Unit III. Measuring Time and Finding Speed and Acceleration Rates

Unit IV. Measuring Mass and Power

Unit V. Measuring Temperature and Energy

It was decided to place these five core units in <u>each</u> of the three modules so that students in all vocational areas would have the same basic metric education. A fence builder or bookkeeper, for example, might not use metric temperature and energy measurements on the job, but both might benefit from the consumer information in Unit V.

The occupational applications units in each module were placed immediately behind the core units, with the first of these applications units designated as "Unit I" of the second major section of the module.

Each module unit was organized with the following elements:

- Terminal Objectives: Behavioral objectives stating subject matter to be covered

- Specific Objectives: Behavioral objectives specifying student performance required to reach terminal objectives

- Suggested Activities: Steps to follow in reaching specific objectives. Activities are listed for both instructor and students.

- Instructional Materials: Outline/listing of unit's instructional materials

- Information Sheets: Sheets containing relevant terms and definitions and other information items needed to reach cognitive objectives

- Transparency Masters: Illustrations for use by instructor to produce transparencies. Some offer new information to students; others reinforce information contained on information sheets.

- Assignment and/or Job Sheets: Assignment sheets are exercises (paper-pencil) giving students practice in use of information covered in unit and may be used in class or in homework assignments. Job sheets serve the same purpose as assignments sheets, but are more action oriented, generally requiring application or demonstration of knowledge or skill in an activity.

- Answers to Assignment Sheets

- Test: Paper and pencil test to measure student's achievement of each unit objective. Some tests include tasks to be performed by student to instructor's satisfaction.

- Answers to Test

- References: Selected supplementary materials

Originally, it was proposed that the module materials be written at the grade 10 reading level. However, results of further investigation and discussion indicated that grade 6 would be a more appropriate minimum reading level. This decision was based on two factors: 1) at each higher age strata in the Spanish-speaking population, the level of education decreased; and 2) overall, 75 percent of the adults in this group had completed more than 5 years of schooling. (Whenever postsecondary and adult students are able to function above this level, teachers could, of course, upgrade presentation of the material.)

The bilingual format of the modules had to respond to the project's primary and secondary objectives. It was thought that if both English and Spanish were to appear together in the same text, there would be a tendency for students to use the Spanish to the exclusion of the English. In addition, one of the major problems in bilingual education, especially at the adult level, is the wide range of language abilities that exists in any classroom. It seemed, then, that the modules should be designed to permit the instructor to alternate between Spanish and English in the most flexible way possible. So a decision was reached to produce two <u>separate</u> language versions of the modules. Outside the classroom, in private study, the two language versions also offer the student excellent opportunities for optimum understanding of metric concepts and for self-tutoring in language development.

<u>Task 2: Develop Introductory Metric Concepts Presentation</u>

SI concepts and standards were used to introduce the metric system, with particular attention given to the most recent available information on international standards being noted. Since an understanding of the decimal

system is essential to utilizing metric measurements, a brief review of decimal notation was included in the core section. Emphasis was placed on the "structure" of metric measurement -- base units, derived units, common prefixes, multiples and submultiples -- to give the learner a firm foundation in the logical design of the metric system.

The "common reference point" approach to instruction was incorporated into the design of the core units since this method (associating familiar terms and concepts with the new) tends to be less confusing for the learner than concentrating on how to convert from customary to metric units of measurement. The transparency masters in the core units further illustrate the linking of metric measurement to familiar objects.

Task 3: Develop Consumer Components for Modules

Final selection of consumer topics to appear in the various module units was based on incidence of normal use and frequency of transactions. The particular consumer components selected for inclusion broadly exemplify applications of a variety of metric units. It was anticipated, for example, that the students' interest in learning to state personal weight, height, clothing size, and caloric intake in metric terms would be especially high.

The consumer applications were analyzed in terms of the types of measurements generally performed and the particular units of measurement normally applied. Based on this analysis, the consumer components were incorporated as appropriate in the core and occupational units. By paralleling consumer information in this way, the "need to know" metrics perception was reinforced.

Task 4: Develop Occupational Applications

For all modules, appropriate clusters of occupations were reviewed to identify representative sets of occupations for inclusion. Occupational clusters developed by the U.S. Office of Education provided the basis for this review. Careful consideration was given to a selection of occupations which, as a group, would provide educational and employment opportunities for both men and women. Analysis was focused within the three vocational areas of Agriculture, Business and Office, and Trade and Industrial.

Several meetings were held with representative organizations and government agencies to explore content for the metric applications within the various occupations. Information available from the Department of Labor, the U.S. Office of Education, and several textbook publishers provided the basis for an analysis of tasks normally performed by persons in each of the occupations finally selected. Tasks in which knowledge of weights and measures would be needed were identified and studied in terms of types of measurements performed or types of knowledge required. Based on the results of this task analysis, the final selection of tasks to be presented, along with the particular metric measurement knowledge required, were incorporated into the design of each unit. Tasks were selected in such a way that, as a group, they would provide examples of the wide variety of applications of linear, area, volume, mass, temperature, and other measures, relevant to the occupations. The design objective for all modules was to offer students a survey of the occupations in their vocational areas, representative tasks

for each occupation, and examples of common applications of metric measurement appropriate to each occupation.

Task 5: Prepare Material in Bilingual Format

As previously discussed in Task 1, during the development of the overall design of the modules, it was decided to produce two separate language versions of the modules. The Spanish language version presents, in parallel, the same metric education material contained in the English language version. The content and format on the pages of the English and Spanish units are generally synchronous; the information contained on the pages of the two versions does not vary from one version to the other by more than a few lines on any one page.

This project recognized that, across the United States, variations exist in the Spanish used by different populations in different regions. Therefore, an effort was made during this translation task to employ an approximate standard Spanish with a minimum bias towards the Spanish used in the Southwest by the Mexican-origin population. It was thought that the bilingual skills of most instructors who work with Spanish-speaking students would be used to clarify any vocabulary problems that might arise.

Task 6: Conduct Field Test

The postsecondary institution selected for the field test was Texas State Technical Institute in Harlingen, Texas. Its administration, faculty, and student body are, for the most part, bilingual. The Harlingen campus is located in a city of approximately 41,500 people. The city is a transportation hub and distributing center for the Lower Rio Grande Valley where commerce is conducted as easily in Spanish as it is in English.

Administrators at Texas State Technical Institute expressed interest in participating in the project field test and made available instructors in Agriculture, Business and Office, and Trade and Industrial Education during the 1978 fall semester. Texas State Technical Institute also assigned a Coordinator of Bilingual Education Services to assist full time with the field test and to serve as liaison and resource person.

In the late summer of 1978, instructor and student field test modules were shipped to the field test site. (The Assignment and Test Answer Sheets were removed from the student modules; all other material was identical.) The Coordinator of Bilingual Education Services and institute administrators familiarized themselves with the manuals, identified the field test instructors, and gave their students general information about this bilingual metric education project during semester registration.

On September 29, 1978, a Field Test Orientation meeting was held in Harlingen at the TSTI campus. Project staff met with TSTI's vice president, three administrative staff members, and four teachers to discuss background information, field test procedures, the structure and suggested use of the English and Spanish metric modules, the pre-test and general testing procedures, the Unit and General Evaluation forms, and the use of the metric teaching aids which were provided for the field test. (Copies of written

materials presented at this orientation session are included in the Appendix of this final report.)

Specific mention was made of the metric consumer information available in the modules and the desirability of sharing this information with the students' families, which were, for the most part, Spanish-speaking. Toward this end, the instructors were asked to encourage their students to take both the English and Spanish modules home when classroom use had been completed. The design of the modules assumed that skills acquired by the students in school can have an impact on parents and others in their homes; therefore, to maximize use of this educational material, it ideally should reach the home environment.

During the orientation meeting, possible class organization and presentation options were examined. The plan preferred by the TSTI staff called for assignment of the metric core units to one instructor who would teach the core metric concepts to all students involved in the field test. The occupational applications units instructors would attend these classes with their students, and thereafter would teach the vocational applications of the modules in each of their vocational specialties.

The teachers were encouraged to adapt the use of both language versions of the modules to the particular language needs of the students to the extent necessary to achieve successful understanding of the metric system and its applications.

The field test began October 10, 1978, with 33 students taking a pre-test in both English and Spanish to determine previous knowledge of metrics. Of these 33 students, 29 scored higher on the English pre-test, one scored the same in both languages, and three scored slightly higher in Spanish. The core units teacher indicated that the average reading level of the students was eighth grade in English and fourth grade in Spanish. Consequently, by student preference, the English version of the core units was used predominately during the 18 hours of instruction. Of the 15 points possible to score on the pre-test, 4 students were able to achieve 10 points or higher; the scores of the remainder of the students indicated that they had little knowledge of the metric system.

The average mathematics competence of the core class students was estimated to be eighth grade level. Initially, the students had some difficulty with decimal notation and changing from one metric prefix to another. As a result, the core instructor felt that if the core instruction was to be completed in the 18 hours allotted, most of the Job Sheet Assignments would have to be omitted. In his judgment, 24 hours would have been preferable for teaching the core units.

During the application units phase of the field test instruction, 14 additional students were enrolled in the project. These were students who had received previous basic metrics education and who expressed interest in knowing how metrics would affect their career fields. The field test continued with the following numbers of students: Agriculture -- 28; Business and Office -- 9; Trade and Industrial -- 10.

The Agriculture application units were completed in 10 1/2 hours of instruction; the Business and Office units were allotted 8 hours (14 hours would have been preferred); and the Trade and Industrial units were covered in 12 hours. The field test was completed by December 8, 1978, and the instructors' evaluations, along with student test scores, were received within the week.

Overall, the Unit Evaluation forms indicated that, from an instructor's viewpoint, the bilingual metric education modules' format was excellent as a teaching tool. Uniformly, comments were made about the clarity of the unit objectives and satisfaction with the "common reference point" approach to learning the metric system. The instructors also judged the module format excellent as a learning tool for the students. Their comments indicated that the examples of consumer applications aroused considerable interest. The Unit Evaluation forms also evidenced a more frequent use of the Spanish language version of the modules in the Agriculture and the Trade and Industrial applications classes (5 to 10 percent of the time). No modifications to the Information Sheets were recommended with the exception of a request for more information on the metric energy unit "joule" addressed in core Unit V.

Task 7: Finalize Module Materials

The Spanish language version of the modules required few corrections or modifications. Changes were, for the most part, accent marks or typographical errors. The TSTI Coordinator of Bilingual Education Services stated that the type of Spanish employed in the modules was appropriate for their Mexican-origin population, and would be suitable for use by most Spanish-speaking populations in this country. Several students and some of the instructors were involved with the Coordinator in proofreading the Spanish language version; reports show the activity as an enlightening and rewarding language experience.

The content revisions required were minor -- some definitions were modified for clarity and a few corrections were made on transparency masters. Other recommended changes were discretionary in nature and were not pursued. One section entitled "SI Metric System Usage and Practice" was added to the introduction pages of the modules. Although this added information had already been included in the Business and Office application units, it was considered important enough to proper metric practice to be made available to users of all three modules.

Task 8: Prepare and Submit Final Products

The final report, along with camera-ready copies of the English and Spanish versions of all three modules -- Agriculture, Business and Office, and Trade and Industrial -- was submitted to the Bureau of Occupational and Adult Education, U.S. Office of Education, in March, 1979.

APPENDICES

September 29, 1978

Field Test

A cooperative effort between Ellis Associates, Inc.,
and Texas State Technical Institute, Harlingen Campus.

Project Title: Bilingual Metric Education Modules for Postsecondary and Adult Vocational Education (Commonly referred to as the Bi-Met Project)

Background

The primary objective of the project is to develop three training packages (both in English and in Spanish) to assure that students with limited English-speaking ability are equipped with the same understanding of metric measurement applications as their English-speaking peers. A secondary objective is language development and reinforcement.

Three training packages have been developed. Each includes five metric concepts, or "core", units, and six or seven vocational application units using metric measurement. The metric core units which are at the beginning of each training manual must be taught before the application units. The application units are intended to be a representative sample of metric applications within an occupational area and are not intended to cover the occupational area in depth. It is estimated that it will take substantially more time to teach the metric core units than it will to cover the occupational application units.

The purpose of the field test is to determine how well the materials work with students, do they do what they are intended to do, and to clarify or correct any item which may need clarification and/or correction.

Only 20 copies of each of the student manuals (English and Spanish) and three copies of the instructor's manual have been printed. Field test teachers will be provided with two copies of the instructor's manual and Ellis Associates, Inc. staff has retained one copy of the instructor's manual. Student's and instructor's manuals are identical with the exception that the instructor's copy has answers to assignment sheets and tests.

The project deadline is March 31, 1979.

Suggested Procedures for Field Test

1. Orientation of field test teachers. Dr. Mary L. Ellis and Mrs. Geraldine Nyland of Ellis Associates, Inc., will assist with the orientation.

2. Selection and screening of potential students. Accomplished by TSTI administration and staff. Remember that only 20 copies of student manuals are available for each of the three classes (Business and Office, Agriculture, and Trade and Industrial Education).

3. Pre-Test students. (English and Spanish)
Assign each student a number (for pre-test purposes only) and ask that this number be used at the top of both the English and Spanish versions of the pre-test. Present the English version of the pre-test to the students first;

then collect them. Present the Spanish version of the pre-test next, and collect these. The pre-test is brief -- both language versions will consume approximately 20 minutes of your first metric concepts class. After you have had time to analyze the results for instructional purposes, please give them to Mr. Rosales who will forward them on to Ellis Associates, Inc.

4. For each module or unit taught, strike out any words, sentences, etc., which are unclear and insert above (in English where appropriate, and in Spanish where appropriate) your printed suggestions for clarification. As each unit is completed, provide your suggested comments on a master copy and send a copy to Ellis Associates, Inc., as soon as possible. This procedure will be necessary if we are to complete our work within the project deadline.

5. Unit Evaluation and General Information forms.
We ask that you complete the Unit Evaluation form for each module unit soon after you have completed your instruction in that unit and turn it in with your unit comments/corrections to Mr. Rosales' office. The evaluation form is straight-forward and hopefully should not place undue demands on your time. Your comments will be of great help to us during the revision phase of this project.

The General Information form can be completed during the last week of the field test. It will give us some needed overall information about your students, your final views of the draft copies of the bilingual metric modules, and your opinion of the general conduct of the field test. It is of special interest to know how you used the two language versions of the modules to meet the needs of the students.

6. Call Ellis Associates, Inc. collect if you have questions. Ask for Mrs. Gerry Nyland or Dr. Mary Ellis. The number is (301) 864-7600.

Thank you for your assistance. We look forward to working with you.

Student No. _____

# PRE-TEST
## INTRODUCTION TO SI METRIC
## BILINGUAL METRIC EDUCATION

Match the terms on the right to the correct definitions on the left by placing the appropriate numbers in the blanks provided. DO NOT GUESS! This test will be used to validate the program you are about to take.

___a. To multiply a quantity by itself three times; symbolized by the exponent "3"

___b. SI metric base unit for measuring length; a little more than a yard

___c. A prefix making a unit of measure 1 000 times larger; multiplying by one thousand

___d. Non-SI unit for measuring volume, particularly liquids; common name for a cubic decimeter; a little more than a quart

___e. SI derived unit for measuring speed; velocity; rate of motion; distance divided by time

___f. SI base unit for measuring mass; about 2.2 pounds

___g. Special name for SI derived unit multiple for measuring power; ten thousand 100 watt bulbs burning for one hour

___h. Energy (work) performed per unit of time

___i. SI unit submultiple for measuring mass; a grain of salt

___j. Base unit for measuring temperature; used for scientific application

___k. SI derived unit for measuring temperature; one hundred degrees (centigrade) from freezing to boiling

___l. Special name for SI derived unit "newton-meter" for measuring energy; energy used to press down ten typewriter keys

___m. Measure of the amount of materials or substance in an object or living thing

___n. Prefix making a unit of measure one-hundredth as large; same as dividing by one hundred or multiplying by 0.01

___o. Measure of the outer boundary

1. meter
2. liter
3. kilogram
4. milligram
5. mass
6. power
7. perimeter
8. meter-per-second
9. kilo
10. cubic
11. megawatt
12. Kelvin
13. joule
14. centi
15. degree Celsius

## UNIT EVALUATION

FOR METRIC CONCEPTS UNIT ___I
___II
___III
___IV
___V

FOR OCCUPATIONAL APPLICATIONS UNIT ___I
___II
___III
___IV
___V
___VI
___VII

Length of Teaching Time Allocated for Your Presentation of this Unit __Hr __Min
Was this Time Allocation ___Too Brief ___Too Lengthy ___About Right
If Too Brief or Too Lengthy, Preferred Time Allocation Would Have Been __Hr __Min

Were the Objectives Understandable to You? ___Yes __No
If No, what Changes Would You Recommend? _____

_____

_____

Were the Objectives Easy to Communicate to the Students? ___Yes ___No
If No, what Changes Would You Recommend? _____

_____

_____

Were there any Objectives or Concepts that Were Especially Difficult for Students to Grasp? ___Yes ___No
If Yes, which one(s)? _____

_____

_____

_____

Was the "Common Reference Point" Approach to Instruction Helpful to You? ___Yes ___No

Your Suggestions, if any, for Modifications to the Information Sheets _____

_____

_____

_____

Your Suggestions, if any, for Modifications to Assignment or Job Sheets _____

_____

_____

_____

Your Overall Comments/Recommendations on this Unit: _____

_____

_____

_____

_____

## GENERAL INFORMATION

Program Area: ___Agriculture ___Business & Office ___Trade & Industrial

Your Estimate of Student Background/Prior Knowledge of Program Area
___Slight ___Moderate ___Extensive

Size of Class _____ Course Title _____

Your Estimate of Student Motivation to Learn Metric System
___Low ___Moderate ___High

Language Version of Modules Used More Frequently ___English ___Spanish

Approximately what Percentage of Time Was Each Language Version of the Modules Used in Class? ____English ____Spanish

Your Estimate of the Reading Level (Average Grade Level) of the Class
____in English ____in Spanish

Your Estimate of the Mathematics Background (Average Grade Level) of the Class ____

Length of Teaching Time Allocated for Your Presentation of the Set of Five Metric Concepts Units _____ Total Hours
Was this Time Allocation ___Too Brief ___Too Lengthy ___About Right
If Too Brief or Too Lengthy, Preferred Time Allocation Would Have Been ____Hours

Length of Teaching Time Allocated for Your Presentation of Occupational Units
_____ Total Hours
Was this Time Allocation ___Too Brief ___ Too Lengthy ___About Right
If Too Brief or Too Lengthy, Preferred Time Allocation Would Have Been ____Hours

Use of Metric Teaching Aids Provided Was ___Minimal ___Occasional ___Frequent

From Your Viewpoint, as an Instructor, the Module Format of the Instructional Material is ___Poor ___Average ___Excellent

From Your Students' Viewpoint, the Module Format as a Learning Tool is
___Poor ___Average ___Excellent

In Your Opinion, Was the General Information on Career Opportunities as Presented on the Information Sheets of Interest or Value to the Students? ___Yes ___No

In Your Opinion, Did the Examples of Consumer Applications Contained in the Modules Serve as Effective Learning Aids? ___Yes ___No

Additional Comments _____

_____

_____

_____

_____

September 29, 1978

ADDITIONAL METRIC TEACHING AIDS
PROVIDED TO EACH FIELD TEST INSTRUCTOR

Texas State Technical Institute
Harlingen Campus

Publications:

"All You Will Need to Know about Metric (For Your Everyday Life)", U.S. Department of Commerce, National Bureau of Standards, Letter Circular 1052, February 1976.

"Metric Guide for Educational Materials", American National Metric Council, 1977.

"Metric Publications", American National Metric Council.

"The Metric System Day to Day", American National Metric Council, 1977.

"Some References on Metric Information Including a Chart on All You Need to Know about Metric", U.S. Department of Commerce, National Bureau of Standards, Publication NBS LC 1070, January 1977.

Visual Aids and Measurement Tools:

Cubic Liter containers (2)

Metric Measuring Tapes (6)

Meter Sticks (3)

Metric Place Value Charts (2)

Metric Wall Chart (1)

NBS Metric Kits, NBS Special Publication 410, National Bureau of Standards (3)

Packages of Centimeter Cubes (2)

Scales (2)

Thermometers (Celsius) (3)